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ABSTRACT

This paper reports a qualitative study in which a small group of 12- and 13-year-old students in a Tucson, Arizona, junior high school designed a school Web site. The study investigated the potential benefits of hypermedia authoring for language arts instruction. Although successful integration of multimedia technology into schools is not without significant challenges, collaborative projects involving Internet publishing can provide an authentic and motivating literacy experience for students. Results indicated that the four traditional language arts processes of reading, writing, speaking, and listening could valuably be expanded to include multimedia-based processes of interpreting and composing. (Contains 10 figures [omitted from this version], 3 tables, and 58 references.) (Author/NKA)

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The Benefits and Challenges of a Student-Designed School Website.

by Maya B. Eagleton

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The Benefits and Challenges of a Student-Designed School Website

Maya B. Eagleton

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Abstract

This article reports a qualitative study in which a small group of 12- and 13-year-old students designed a school website. The study's main purpose was to investigate the potential benefits of hypermedia authoring for language arts instruction. Although successful integration of multimedia technology into schools is not without significant challenges, collaborative projects involving Internet publishing can provide an authentic and motivating literacy experience for students. Results of this study suggest that the four traditional language arts processes of reading, writing, speaking, and listening could valuably be expanded to include multimedia-based processes of interpreting and composing.

The article is available in both a hypermedia and a downloadable text-only version. The hypermedia version contains audio files that may require updated software for proper playback. Readers who experience difficulty with audio files may choose to download the most recent version of QuickTime, available without cost from Apple Computer, or can read the corresponding file transcripts that appear within the article text.

Author Information

In April 1999 when this article was originally posted, Maya B. Eagleton (e-mail meagleton@cast.org) was completing her doctorate in language, reading, and culture at the University of Arizona, with a focus in technology and literacy. Her degree has subsequently been awarded, and she is now a research associate and instructional designer at the Center for Applied Special Technology in Peabody, Massachusetts, USA. She has worked in education for 15 years, focusing on special needs learners at the elementary and middle school levels. She is an experienced Reading Recovery teacher and served for many years as a coordinator for Title I, the compensatory education program sponsored by the U.S. federal government.

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Introduction

Background | Research Questions | Theoretical Framework

Background

Computers and telecommunications technologies are infusing schools in the United States at an exponential rate, and it has become incumbent on educators to gain an understanding of the unique benefits and challenges of integrating hypermedia technology into the curriculum. We are in a remarkable time in the history of education in that we can no longer accurately predict what kinds of literacy skills today's kindergartners will need upon graduation from high school (Leu, in press). Unfortunately, there is a shortage of research in this area. Reinking (1998), citing Kamil and Lane, reports that less than 1 percent of articles published in four leading educational research journals during a recent 3-year period addressed issues related to technology. Educators, therefore, are left facing monumental challenges with little support or guidance.

The pilot project described in this article was undertaken to explore the pedagogical benefits and challenges that exist when students engage in hypermedia design projects and, specifically, to investigate the potential benefits of such projects for the language arts curriculum. By collecting artifacts, surveying, interviewing, and observing a small group of students as they designed their school's website, I explored the language and literacy processes involved in working with hypermedia technology for authentic purposes.

To contextualize the critical issues surrounding this case study, three key areas of concern to educators are explored in this section: policy issues, curricular issues, and literacy issues.

Policy issues. Educational policy makers must grapple with several issues concerning appropriate and effective integration of computers into schools. First and most critical is funding. Never before has the educational community been called upon to finance such an expensive innovation. Seemingly limitless supplies of money are needed to buy or lease hardware and software, to maintain and upgrade equipment, to compensate technology coordinators and technical experts, and to provide release time for planning, training, and staff development. There is unprecedented community pressure on school districts to provide technological resources to their students, but doing so is often at the expense of other valuable programs and resources such as music, physical education, art, or even libraries.

The second key policy issue is equity. Disparities in socioeconomic resources result in discrepancies in the availability of computers and Internet access among school districts, and between children who have access to computers at home and those who do not. This suggests a possible educational and societal advantage for the computer "haves" over the "have nots." However, it has always been the case that more affluent families and

districts have educational advantages, and it is not clear how the current disparity in access to technological resources compares in magnitude.

Finally, there is a serious policy issue having to do with assessment. It is critical that assessment practices be reexamined in light of any educational innovation in order to ensure that a match between objectives and outcomes is maintained. At present it is unclear exactly what kinds of educational outcomes can be expected with the advent of multimedia technology, and some educators may fail to see the benefits of spending time and resources on computers. As one school administrator recently lamented to a colleague of mine, "We've spent thousands of dollars on computers, but our test scores still haven't gone up!"

Irrespective of the challenges, educators are responsible for implementing mandates from various levels of government for the dissemination of technology. In the United States, the Clinton Administration has a widely publicized goal of bringing multimedia technology and the Internet into every public school by the year 2000. The "Technology Literacy Challenge" developed by the Office of Educational Technology of the U.S. Department of Education lists four criteria necessary for ensuring that "all children are technologically literate by the dawn of the 21st century":

1. modern computers and learning devices that are accessible to every student;
2. classrooms that are connected to one another and to the outside world;
3. educational software that is an integral part of the curriculum and is "as engaging as the best video game"; and
4. teachers who are ready to use and teach with the technology.

The International Society for Technology in Education recently released a set of standards by which educators can measure students' technology skills at grades 2, 5, 8, and 12. School districts around the world are frantically developing technology plans despite the lack of complete understanding of how new technologies may affect students' learning.

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Curricular issues. There are several themes that must be highlighted when discussing the potential impact of computers on the K-12 curriculum. First, teachers must understand how and when to use computer technology most effectively; second, they need to know how to select appropriate software; and third, they must be able to frame computer-related activities to maximize the benefits for student learning.

In choosing how and when to use technology, it is essential that teachers have a clear sense of their own instructional objectives. For example, if my primary goal as a reading teacher is to help students learn to encode, recode, and comprehend *print*, then my instruction would center on printed rather than electronic text. If, on the other hand, my goal is for students to learn how to send and receive e-mail, find resources online, and navigate hypertext environments, then instruction would focus on using hypermedia technology. Perhaps less obvious, if my goals also include motivating and engaging students, encouraging collaboration, and providing students with an authentic sense of audience when they write, then it would most definitely be appropriate for me to incorporate hypermedia design projects and the Internet into my curriculum.

Closely related to the topic of appropriate use of technology is knowing what kinds of software products are available and ensuring a match between those selected and teachers' orientations. There is an important distinction between ready-made software programs designed to *present* information and those designed for users to *construct* information. This distinction is analogous to presenting students with a commercially prepared textbook versus handing them a toolkit of writing, art, and photography supplies. Clearly, using these materials involves entirely different processes, serving entirely different objectives.

Language arts-related software designed to *present* information (such as an interactive storybook, a game, or a comprehensive reading program) can be based on a skills model, a holistic model, or some combination of the two. Sometimes the philosophical orientation of the software publisher is not obvious until the software is previewed; therefore, educators should try to do this whenever possible. Presentation software can be beneficial in the classroom if it is well designed, affordable, and easy to use, and if it matches the teacher's instructional philosophy.

Open-ended software designed to enable the student to *construct* information (such as the word-processing programs, database programs, and multimedia composers that Jonassen, 1996, has labeled "mindtools") is often more difficult for teachers to implement, but the rewards for students can be worth the effort. The demands of introducing these programs are similar to those placed on teachers who move their curricula away from commercial basal readers to an inquiry-based approach. Often it requires teachers to shift out of their accustomed role of "information givers" to become "learning facilitators" (Lehrer, Erickson, & Connell, 1994), particularly since students may quickly move beyond the expertise of their instructors.

Finally, teachers need to know how to frame computer-related activities for maximum benefits to student learning. Simply placing a computer in a classroom does not guarantee increased learning opportunities. Everything depends on how it is used. If students are permitted to engage in aimless surfing on the Internet or endless hours of arcade-style gaming, then it is doubtful they will learn the kinds of things we want them to learn. Further, if a teacher perceives the computer as an electronic babysitter, a place for students to play when all the "real work" of learning is done, this message will be communicated to students. In 1984, Salomon introduced the notion of "amount of invested mental effort" (AIME) on a task, a notion still very much applicable today. If we don't present computer-related tasks as valuable while also demanding accountability from those who engage in them, then students will relate to computers in the same superficial way that they often relate to television.

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Literacy issues. The discussion surrounding the potential impact of computer technology on literacy centers on the question of whether hypermedia constitutes a "revolution" in the forms and functions of literacy. Notable educators such as Emilia Ferreiro, Margaret Meek, and William Teale encourage us to situate computer-based literacy within a historical context, placing electronic texts alongside such monumental inventions as the ancient papyrus roll, the medieval codex, and the printed book. Teale (1997, p. 81) writes,

> The invention of written language some 3000 years ago promoted new modes and registers of communication. Over the millennia, written language has come to play essential roles in the activities of our daily lives. Becoming an integral part of our daily activities also meant that the technology of written language changed our ways of thinking. In other words, people in today's literate societies think somewhat differently from nonliterate persons in nonliterate societies because they use literacy as a tool to mediate their activities.... I think that computer-related technologies have the potential to affect human thinking and communication as much as the technology of written language has. In this sense, technology should be an issue of great concern to language arts educators.

Goodman (1996) talks about how new language forms arise in a culture when the needs of the culture demand them. While he refers to the advent of written language in oral cultures, the same model could hold true for hypermedia. In the same way that print should not be considered merely a "simulation" of oral language but a language form in its own right (Goodman, 1996), many educators believe that electronic text represents an entirely new language form governed by its own idiosyncratic semiotic freedoms and constraints (see, for example, Bolter, 1991; Snyder, 1996). If it is true that "media can be defined by [their] technology, symbol systems, and processing capabilities" (Kozma, 1991, p. 180), then hypermedia embodies a substantively new order of human discourse.

According to Bolter (1991), each new technology of writing brings us a fresh physical and conceptual "writing space" that "fosters a particular understanding both of the act of writing and of the product, the written text" (p. 11). Each of these different writing spaces promotes different styles and genres of writing and different theories of literacy. Today, hypermedia writers are still in the process of discovering what these new structures and genres may become; in fact, we are in a time of such rapid technological change that "clearly, the literacy of yesterday is not the literacy of today and it will not be the literacy of tomorrow" (Leu, in press).

Hypertext itself may actually change the fundamental relationship between the reader, the author, and the text by permitting a *literal* transaction between reader and text (Reinking, 1994). Not only can an electronic text be programmed to adapt and respond to an individual reader's needs and interests during reading, hypertext environments allow the reader to select her or his own path through extensive networks of textual and multimedia information (Reinking, 1992). Readers can even choose to re-author portions of the encountered "text" by altering its content, layout, or appearance.

In my own thinking in this area, it has come as a great surprise to me that hypermedia-based discourse actually seems to share more characteristics with oral than with print-based language (see Table 1). Perhaps we have been missing the point entirely by perpetually comparing electronic text with printed text rather than viewing hypermedia literacy in relation to oral literacy.

Table 1
Characteristics of Language Forms

Print	Oral	Hypermedia
noninteractive	interactive	interactive
permanent	impermanent	impermanent
static	dynamic	dynamic
linear	nonlinear	nonlinear
narrative	narrative/episodic	episodic
single voiced	single/multivoiced	multivoiced
graphic	audio	all symbol systems

Some of the characteristics shown in Table 1 (such as the notion that print is "noninteractive") are certainly open to debate, and it is apparent that scholarly conversation surrounding the relationship between hypermedia and traditional language forms has only just begun. For example, some have suggested that hypertext lends itself to episodic, rather than narrative, story structures (McLellan, 1992) and that this changes the essential rhythm or landscape of reading. Similarly, a poststructuralist might be interested in how hypermedia easily accommodates "multivoiced" text rather than the more traditional single-voiced narrative. In sum, each medium has distinct strengths and weaknesses in terms of how we express ourselves and make sense of the world around us. Language arts instruction is all about helping students construct and communicate meaning to others; therefore, it is imperative that we investigate the potential impact of computer technology as a meaning-making tool in the language arts classroom.

If language arts educators are concerned with facilitating students' use of strategies that are relevant to their daily lives and will be useful 20 or 30 years hence, then we have an obligation to familiarize ourselves with advances in technology. According to Reinking (1994), "the inexorable pace at which electronic forms of written communication are expanding strongly suggests that educators must become familiar with the essential nature of electronic texts. Only then will we be able to lay the foundation for developing an electronic literacy that will prepare us for the future" (p. 16). Furthermore, the traditional definition of *literacy* itself may need to be expanded to include multimedia and hypermedia texts. As Kinzer and Leu (1997, p. 126) observe,

> We live during a time when fundamental change is taking place in the nature of literacy and learning as digital, multimedia resources enter our world. Literacy and learning are being redefined by the digital communication and multimedia technologies that are quickly becoming a part of the information age in which we live...multimedia and hypermedia technologies are changing traditional definitions of literacy and learning.

In the past, computer technology has tended to be associated with math and science curricula; however, with today's telecommunications technologies and multimedia applications, computers are establishing a legitimate role in the humanities and communication arts.

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Research Questions

The study described in this article was focused intentionally on an implementation of hypermedia technology as it related to curricular and literacy issues. This is not to suggest that policy issues are unimportant. For me, however, discussion of whether we should be infusing schools with computers has become almost moot: they are already in schools in great numbers. A more critical issue may now be how we, as language arts educators, will capitalize on using them in our instruction.

The following questions served as focal points for the investigation:

- What do grade 7 and 8 students perceive as the purposes of creating a school website?
- What are the pedagogical benefits when students design a school website?
- What are the pedagogical challenges posed when students design a school website?
- What are the pedagogical benefits specific to language arts?

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Theoretical Framework

This study reflects a semiotic-sociocultural-constructivist stance on the nature of learning and literacy. Through this lens interactive multimedia technology can be viewed as a culturally valued mediational tool for facilitating authentic literacy experiences in inquiry-based classrooms.

Educators and researchers who subscribe to a semiotic viewpoint suggest that what makes us human is our capacity to create and interpret signs and symbol systems (see, for example, Eisner, 1991; Gardner, 1983; Harste, 1994; Suhor, 1984). Because we can never know the world directly, we use signs (defined as anything that we use to convey meaning, including pictures, words, gestures, and objects) to mediate it (Suhor, 1992). From this perspective, the goal of literacy instruction is to teach children command of a variety of symbol systems and how to utilize "multiple ways of knowing for purposes of ongoing interpretation and inquiry into the world" (Leland & Harste, 1994, p. 339).

It is important to expose children to multiple forms of symbolic representation because each is uniquely capable of addressing different aspects of the world (Kozma, 1991; Salomon, 1997). Further, "the forms we use to represent what we think -- literal language, visual images, number, poetry -- have an impact on how we think and what we can think about. If different forms of representation performed identical cognitive functions, then there would be no need to dance, compute, or draw" (Eisner, 1997, p. 349). Forms of representation need not be taught as ends in themselves, however, but should be viewed as tools that students can use for thinking and communicating (Eisner, 1994; Greeno & Hall, 1997).

In multimedia technology, multiple symbolic forms are combined, thereby offering the possibility of greater educational equity for children who, for example, may be more visually than linguistically oriented (Kinzer, Gabella & Rieth, 1994; Wilhelm, 1995). This rich multimodal resource combines elements of written language, dynamic images, audio, video, animation, and graphic design in order to enhance its communicative power (Downes & Fatouros, 1995; Glasgow, 1997; Reinking, 1994). With this technology, it is possible "not only to convey words but also to convey their inflections, the accompanying gestures, the surrounding action, the visual context, and other nonverbal communication" (Rose & Meyer, 1994, p. 291). Furthermore, it allows us to make meanings through combinations of symbol systems that we could not make, or make as well, through any of the systems on their own (Lemke, 1992).

Some educators suggest that "constructing meaning from multiple perspectives, using multiple media sources, provides a richer understanding of complex information, especially if one lacks prior knowledge about a topic" (Kinzer & Leu, 1997, p. 130). In a fascinating semiotic analysis of young children at work in a classroom computer center, Labbo (1996, p. 381) discovered that

> The computer also seemed to offer unique support and mediation for children's construction of meaning about the process of symbol making.... Children were able to draw on their understanding of the purposes and forms of the language arts (e.g., listening, speaking, and writing) as they intertwined processes related to fine arts (e.g., using color, line, and text) and multimedia arts (e.g., visualizing,

creating dynamic screen effects, accomplishing animation through manipulation of icons).

The computer's unique capacity to transform information instantaneously from one symbol system into another capitalizes on the power of transmediation for children's literacy development (Dickson, 1985; Labbo, 1996; Snow, 1997). Transmediation refers to "taking a content and expression plane of one sign system and recasting it in terms of the content and expression plane of another sign system" (Harste, 1994, p. 1226). Because correspondence between different modes of representation is not one to one, the tension between symbol systems forces learners to create their own links between systems of representation. The opportunity for children to experiment with transmediation within a flexible multimedia environment may lead to a greater understanding of complex information and to multiple ways of knowing (Blackstock & Miller, 1992; Kozma, 1991). However, educators must be cautioned that poorly designed educational software, difficult-to-navigate hypertext environments, and the Internet can also lead children away from their central purpose.

As children become proficient users of multimedia technology, they may invent new forms of meaning that we have not yet imagined. If "representations are constructed for specific purposes during attempts to solve problems and communicate with others about these attempts" (Greeno & Hall, 1997, p. 365), then the problems children face in the future could inspire them to use technology to fashion unusual and innovative symbolic products (Eisner, 1994; Gardner, 1983). This may require language arts educators to extend the four generally recognized language arts processes of reading, writing, speaking, and listening to include literacy events within multimedia environments (Downes & Fatouros, 1995; Lehrer, Erickson, & Connell, 1994). As Teale (1997, p. 81) notes:

> Technology is necessitating a redefinition of literacy. Traditionally, we have thought of literacy as reading and writing text. But now, multimedia capabilities mean that texts can be combinations of written words, visual images, and sound.... [T]echnological developments are affecting the very nature, processes, and uses of literacy. The creation of such new modes of interacting with texts suggests that we need to broaden our notion of literacy and even think in terms of literac*ies* rather than literacy .

From a sociocultural perspective, hypermedia technology is rapidly becoming a valued means of communication and has the potential to evoke authentic uses of language through students' collaboration with others (Dyson, 1993). These meaningful social interactions can boost learners to new levels of independent achievement within their "zone of proximal development" (Vygotsky, 1978). The awareness of a wide audience for their work inspires students to use greater care in producing high-quality products and encourages collaboration regarding content and design (Barkhouse, 1997; Cohen & Riel, 1989; Downes & Fatouros, 1995; Jones, 1994; Owston, 1997).

A constructivist or inquiry-based model of instruction invites both students and teachers to engage in a collaborative negotiation of the curriculum (Harste, 1994; Short & Burke, 1991; Short, Schroeder, Laird, Kauffman, Ferguson, & Crawford, 1996). Dewey (1938, p. 67) describes this collaboration as follows:

> There is, I think, no point in the philosophy of progressive education which is sounder than its emphasis upon the importance of the participation of the learner in the formation of the purposes which direct his activities in the learning process, just as there is no defect in traditional education greater than its failure to secure the active co-operation of the pupil in construction of the purposes involved in his studying.

In an inquiry-based classroom, multimedia technology and the Internet can be viewed as avenues for learners to use critical thinking and problem-solving strategies to transform information into knowledge (Jonassen, 1996). Furthermore, "teaching in an online setting challenges teachers to shift paradigms and use a constructivist model of learning" (Peterson & Facemyer, 1996, p. 53). Teachers are increasingly redefining traditional notions of instruction, and it is interesting to observe how technological developments are occurring simultaneously with the movement toward constructivist models of teaching and learning (Ayersman, 1996; Brown, 1991).

In the study described in the remainder of this article, I demonstrate how a hypermedia authoring project built on this theoretical framework gave students an authentic, constructivist literacy experience.

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Method

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Setting and Participants

The school. The research took place at Flowing Wells Junior High School (FWJHS) in Tucson, Arizona, USA. This school enrolls approximately 1000 students in grades 7 and 8 and is the only junior high in a small district with one high school, one alternative school, and six elementary schools. It is located in a middle- to lower-income neighborhood; according to one source, the school is located in the area of Tucson that has the highest percentage of welfare recipients in the city. The student population is predominantly Caucasian and Hispanic, but small numbers of Native American, African American, Asian Pacific, and ESL students also attend.

In addition to a gym and cafeteria, the FWJHS campus consists of nine "pods" -- octagonal buildings with wedge-shaped classrooms. At the center of each is a large common area with eight teachers' desks. Because of this structure and the leadership of Karen Blair, the 24-year veteran school principal, FWJHS has a very close-knit staff.

The school follows a modified block schedule in which students enroll in eight courses and attend four each day, with each class meeting for 90 minutes every other day ("blue days" and "gold days").

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The media arts class. At the time of this study, the traditional "newspaper" elective had recently been renamed "media arts," split into two sections (blue and gold), and taken over by Marc Hamilton, an innovative teacher with six years of middle school experience in English literature, American studies, geography, and study skills. Marc also holds an administrative certificate and is considered a school leader in technology and curriculum design. He is a strong believer in inquiry-based education and allows his students a great deal of autonomy in designing their own project-oriented curricula.

Marc's emphasis on *all* of the media arts enabled his students to explore desktop publishing, video production, digital photography, and webpage design with the ultimate goals of creating a school website, publishing the school newspaper online, and linking members of the student council electronically with student leaders around the United States. Marc allowed me to participate in establishing these goals and in working with students toward them. At the outset of this study, I attended both media arts classes as the primary web design instructor three to four afternoons per week, on equal numbers of blue and gold days.

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The students. In the fall of 1997, I solicited student volunteers from the two media arts classes for the "web crawlers" team. All potential volunteers completed an interest survey, and based on the results, six students were selected -- three from the blue group (April, Jason, and Skye) and three from the gold (Danielle, Maria, and Brian). (All names are pseudonyms.) Because the students came from different classes, they worked on

the project in two teams of three, meeting together as a whole on only one occasion.

The phrases I have associated with each student describe her or his self-designated primary role.

April, the "Technical Expert," is a self-described "computer nerd" and was one of the most productive members of the team. Prior to the study she had taught herself to do word-processing but she had never been on the Internet. In an initial interview, April stated, "Well, actually, I really haven't been using [computers] that long, but my cousin is a computer whiz and I went and stayed with him for probably a week and he taught me everything, pretty much everything he knew. And, plus, I just got on the computer and I messed around in the summertime and it was so boring, so I just sat on the computer, like 24 hours a day, 7 days a week. I just, when I woke up I was on the computer and I learned a lot about it that way."

April's technical ability was considered a valuable commodity by her classmates; in fact, her web design work was often interrupted by other members of the media arts class who needed technical assistance with other computer projects. April also has a creative sense of color and design (see Figure 1).

Figure 1
April's Brag Page

[image omitted]

Jason was the "Writer." He sports baggy pants, buzz-cut hair, and a "cool" persona. He impressed us with his dedication to the web project and his interest in learning more about computers for his own future benefit. Jason's family doesn't own a computer so he had the least computer experience in the group, had never been on the Internet, and was somewhat intimidated by technical problems; however, of all the web crawlers, he and April are the two who plan to register for a new web design elective when they enter high school. In response to some peer ridicule at his plan to take computer classes in high school, Jason said, "It won't kill me to spend one period a day with nerds. Hey, nerds are the ones with good-paying jobs."

Although Jason does not view himself as a good speaker or grammarian, his writing on the website was extremely creative and engaging. An example of Jason's humorous slogans appears in the sports section of the site (Figure 2).

Figure 2
Jason's Track Page

[image omitted]

Jason's biographies of FWJHS staff members are also amusing, as exemplified by the headline on the staff webpage (Figure 3).

Figure 3
Jason's Teacher's Page

[image omitted]

Skye, the "Surfer," spent more time online browsing for free graphics, buttons, and backgrounds for the website than did the other crawlers; she even took floppy disks home to save graphics she found while surfing on her mother's computer. Skye's disks became the primary source of graphics for the group. She was very concerned with the appearance of the site and spent countless hours sampling color schemes.

Although Skye is a bright student and possesses a great deal of knowledge and technical expertise, she also tends to daydream and needed supervision to remain focused on the task. She spent some of her time surfing entertainment websites, saying she was "looking for ideas." However, when encouraged, she produced some impressive sections for the school website (see Figure 4).

Figure 4
Skye's October Students of the Month Page

[image omitted].

Danielle was the "Artist." One of those well-rounded, excels-at-everything-she-tries students, Danielle is an exceptionally talented artist and writer. She is also a top athlete. Prior to the project Danielle had some experience with word-processing in school but had never been online. Her significant contribution to the website was to draw the background image and the navigation buttons offline and, with help, to scan and digitize them (see Figure 5). Beyond that, she never really "took" to the computer and spent more time handling her student council responsibilities than she did on the web project.

Figure 5
Danielle's Artwork

[image omitted]

Like Danielle, Maria, our "Community Link," was a student council member. Because of her knowledge of the school's infrastructure, Maria could be relied on to find information that the crawlers needed for the website. She spent a lot of time out of the classroom locating yearbook photos and lists of students of the month, soliciting student artwork and writing, and interviewing faculty members.

Although Maria is computer literate and has Internet access at home, she has so many other interests and social activities that she wasn't satisfied sitting in front of the computer for long stretches. She contribute very little actual programming on the site aside from some very well-organized tables (see Figure 6), preferring to serve as an information gatherer for the more technically inclined web crawlers.

Figure 6
Maria's Student Honors Page

[image omitted]

Brian, the "Photographer," was the only seventh grader to volunteer for the project. He is registered for media arts again for grade 8 and will have an important role in training the next group of web crawlers. Prior to this study, Brian had surfed the Internet from home on a few occasions and had gained a moderate amount of experience working with computers. His major contribution to the project was using the digital camera to photograph staff members, downloading the images, converting them to the proper format, reducing the file size, saving them, and inserting them onto the webpages. This required a significant amount of patience and technical expertise, and Brian did this task without complaint.

Brian also has a good sense of color and design (see Figure 7). He was one of the few crawlers who consistently maintained the school colors (blue and gold) and mascot (mustang) throughout his pages.

Figure 7
Brian's Staff Page

[image omitted]

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Equipment

Hardware. The media arts classes are housed in a five-year-old networked PC lab that contains one file server, one teacher's computer, one printer, and thirty 486 student computers. Each student computer runs Windows 95 with a 66 MHz processor, a 500 MB hard drive, and 8 MB of RAM. The computers are used by more than 150 students and adults per day. Because of this, and because the school district is small and lacks adequate technical support, the printer and most of the computers are temperamental and challenging to use. The lab also has a telephone with an outside line, a modem, two video cameras, an analog video editing deck, a digital camera, an LCD projector, and a flatbed scanner.

Software. The school is not yet wired for the Internet, so I installed file-sharing software on the teacher's computer and four of the student computers so that all five could share one modem connection. This meant that the student (client) computers depended on the teacher's (server) computer for their outside line. The dial-up service was initially my own personal account, but later in the study the school principal chose to fund a permanent school account that now hosts the website (which can be viewed at http://earthvision.asu.edu/~maya/fwjhs).

The teacher's computer is equipped with dial-up software, and digital camera and scanner software; in addition, each of the five computers used in this study was outfitted with Netscape Navigator Gold (for browsing and composing); Paint Shop Pro (for digitizing and converting graphics) and Microsoft Word (for word-processing). Due to time and equipment limitations, the students did not explore audio or video production for the website.

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Procedure

Data Collection | Data Analysis

Data Collection

The phase of this study reported here was conducted over the course of one fall semester (approximately 11 weeks, excluding holidays). The primary data sources can be grouped into three categories: interviews, participant observation, and artifacts.

Each of the six student participants was interviewed once toward the beginning and once at the end of the project, with a focus on experiences with language arts, computers, the Internet, and constructing the website. All of these semistructured interviews were audiotaped and transcribed. The media arts teacher was interviewed twice during the semester, and the school principal, Title I coordinator, and a language arts teacher were also interviewed at length toward the beginning of the project (results not reported).

All 90-minute class sessions were videotaped (for a total of 1,620 minutes of transcribed tape) for later analysis. In addition to videotapes and transcriptions, I kept a researcher reflection log in which I wrote immediately after each class session for purposes of later coding and analysis. Informal conversations with the students and with the media arts teacher were also used as data sources.

Finally, documents and artifacts collected included lesson plans, lesson handouts, students' daily reflection logs, student surveys, and webpages and the website (which can be viewed at http://earthvision.asu.edu/~maya/fwjhs/).

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Data Analysis

All information gathered in this study was coded and analyzed using an inductive, or emic, approach.

Categories and thematic connections were derived from the data using a spiraling reduction process (see, for example, Creswell, 1998; LeCompte & Preissle, 1993; Miles & Huberman, 1994; Seidman, 1991; Spradley, 1980). Combing through the data set proceeded in several iterative stages: (1) searching to derive initial categories, key words, and thematic connections; (2) probing for disconfirming evidence; (3) searching through the data several more times; and (4) regrouping the data into new categories. Member checks were not carried out because winter holidays made the student participants unavailable; however, the media arts teacher was consulted before final thematic categories were established.

The first stage of data analysis elicited themes identified by key words such as "school pride," "collaboration," "motivation," and "expression" (see Table 2, part 1, for a complete listing). Eventually many of these categories were collapsed, renamed, and reorganized under the four major research questions, evolving into the format laid out in the second part of the table. It was determined that saturation had been achieved when each relevant data bit (defined as a participant quotation, a transcribed unit, or a unified portion of an artifact) had been successfully grouped into one or more thematic categories, and when the leftover data bits were determined to be irrelevant to the research questions at hand.

Table 2
Evolution of Themes

Part 1: Initial Themes

21st century	audience	collaboration	empowerment
expression	hardware	information	learning
listening	motivation	new sights	processes
publishing	purpose	reading	research
school pride	speaking	technical	time
	voice	writing	

Part 2: Final Themes

1. Purposes for the website	3. Pedagogical challenges
global voice	time
keeping with the times	equipment
school pride	technical skills
attracting future students	disharmony among students
2. Pedagogical benefits	3. Language arts benefits
empowerment	print literacy
motivation	oral literacy
collaboration	hypermedia literacy

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Results and Discussion

Purposes | Benefits | Challenges | Benefits for Language Arts

The following questions served as focal points for the study

1. What do junior high students perceive to be the *purposes* of creating a school website?
2. What are the pedagogical *benefits* of a student-designed school website?
3. What are the pedagogical *challenges* of a student-designed school website?
4. What are the benefits specific to *language arts* instruction of a student-designed school website?

Purposes

In one of our first sessions, the students and I had a discussion about the purposes for creating school websites. At that time, most of the students were still unclear about how the Internet worked and how their project would fit into the global picture. The general sentiment was that the project would "let people know about FWJHS" (Maria) and help them "learn about the Internet" (Jason). By the end of the project, the students had identified several additional reasons for developing a school website: (1) giving students a global voice, (2) keeping up with the times, (3) communicating a sense of school pride, and (4) attracting new students to the school. To my knowledge, none of these themes is present in the research literature to date.

One of the study's more dramatic findings was how vital it was to these students that they have a voice -- "I want...people to be drawn to see what we have to say" (April). They perceived that constructing the school website provided them with an authentic venue for expressing themselves to a worldwide audience. As Danielle proclaimed, "The world is our audience -- they are ours to entertain." Students in this age group hold an unenviable position "right smack in the middle" (as Danielle noted), and they are often overlooked as legitimate contributors to society. Jason communicated his stance from the marginalized middle quite simply: "We're here...and everybody can find out about it." One of the most powerful statements on this theme came from Danielle:

> [I want to] let people know what we're doing in our community and to show people that there is schools out there that are caring, that are doing stuff and it's just not, we're all not just throwing away our youth. We're actually doing something here, and I think the world should know about it instead of just brushing us off as worthless.

The students also wanted to show the world that FWJHS is up to date, and the development of the school website seemed to symbolize this for them. I was surprised to find that these students had such a potent sense of their position in a society of technological haves and have-nots. As Brian briefly explained, "Well, 'cause we gotta catch up with the times!" Danielle echoes this perception in her lament that "it's moving, the world of technology is moving, and you gotta catch up with it and my family is way behind on this one, I think. And we've gotta catch up." Jason is also highly aware of the increasing role of technology:

> People say that the world is gonna be computers soon, so I might as well start gettin' into the computers more, I mean, like, every, everybody always has a webpage, even at Circle K and toilet paper places. [So, if you don't know about] that you're kinda clueless on what's going on in the world.

The perception that creating a school website would indicate technological advancement and accomplishment promoted a sense of school pride. As Maria boasted,

> Well, because we have, like, a good academic program. Everybody should -- not everybody but, like, people that use the Internet -- should be interested in learning that. And basically, for the most part, we have good students and, like, we should be able to show everybody that. And the teachers are good, some of them. But, uh, everybody should.... I don't know, it's just that FWJHS is a good school and everybody should be aware of that.

Maria had a feeling of ownership and pride even before we started creating the site. As she wrote in her reflection journal early in the project, "I'm pretty sure that once we start construction on the website it's going to be totally awesome! I'm pretty sure other schools are going to be jealous of our website. Because ours is the best!" Skye communicates similar feelings of school pride in the well-crafted introduction to the student writing webpage shown in Figure 8.

Figure 8
Skye's Student Writing Page

[image omitted]

April describes her sense of pride with a dramatization of someone who stumbles onto the school's website:

> Well, I think that it'll show people what Flowing Wells is like. When you're on the Internet and you're going, you're checkin' out all these schools, you see all these boring webpages. "Ahhhhahhhahuuuh"--you know, you're yawning and then you turn and you see the Flowing Wells webpage and it's so vibrant and obnoxious you go, "Hey, I wanna go to that school!" So, it gives us, like, a person's personality; it shows our school personality.

This notion of attracting people to their school was the fourth theme that emerged in the students' descriptions of the purposes for creating school websites. Skye recalled that when she moved to Tucson, she and her mother had driven all around the city looking for schools. Had there been a school website at that time, "it would've been easier to find out, like, a lot of information and stuff to see if you wanna go to the school." Jason took this idea a giant geographical step further: "If you're moving.... I mean, you could be in Russia or something and find out about our school if you're coming to America."

To summarize, the students identified several compelling reasons for having school websites. Although many of these purposes can be accomplished if adults create and maintain the site, giving students ownership of it allows them to use their own voices to represent the culture of the school.

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Benefits

Several profound pedagogical benefits emerged when these students created their school website. I will discuss each in turn, again letting the students themselves tell the tale of their experiences as web authors.

In this first [transcript of an] audio clip, Maria describes the sense of empowerment she gained as a result of being a part of the project:

> I think it would be a cool experience to say, like in 20 years, that I helped create Flowing Wells' first webpage. I just think it's a cool experience just to be able to say that I actually created a website and, like, to go back and look at it at another computer and, like, say, "I helped create that." I just think that's gonna be a neat experience.

All of the students spoke of a similar sense of empowerment. Danielle shared this sentiment: "I feel special and I feel smart 'cause I'm doing something that 96% of the school doesn't know how." Brian related, "I feel that it's really an honor, the first time that FWJHS has made a webpage. [I] can say, 'I did it!'" April's vision of her permanent mark on the history of the school extended far into the future:

> To say, well, in a hundred years, or a thousand years, a million years and a person says, "Well you know, back in 1997, a century ago, you know, that old school, it's been burnt down now, there was a girl there, her name was [April] and she created the webpage." And everybody's like, "Woooowww."

Not only did these students gain a sense of empowerment from their unique role as the creators of the school website, but the computer skills they learned gave them a sense of confidence in their ability to face their future in a technological society. As Jason stated,

> I used to be a lot more scared to use other people's computers 'cause I didn't know what I was doing. Now I could...I could go on and know what I was doing more. It helped me out. And I know, later in life it'll help me out a lot to know stuff like that.

Maria described the computer literacy she gained in this way:

> I like learning about the computer and seeing things I've never really seen before -- like, I've never...I didn't know that you could go on the computer and get free backgrounds to make your own webpages. I didn't know that, and I think it's good for me to know that. And I didn't know that anybody with Netscape Navigator Gold could go and make their own webpage. I thought you had to be some, like, high and mighty person to have your own webpage, but now I know better than that. But, I just think it's cool to be able to know how to make a webpage; it's something that I'll probably know all of my life until I get old and senile.

April talked about some additional ways in which the project gave her more confidence as a learner:

> I've learned a lot about the Internet. Now I can get on the Internet and do things. You know, I don't have to have someone there to hold my hand and tell me what to do. Um, I think I've learned to be more assertive and more responsible.... [Mr. Hamilton] tells us, you know, "go to work," and we have to know what to do. We don't just sit around.

In addition to a providing a profound sense of empowerment, the privilege of working on the school website and using computers was a strong motivating force for the students. Motivation is a consistent theme in the literature on the use of computers in the curriculum. Almost all children seem to be motivated to use computers -- so much so that it is sometimes difficult to get them off the computers at the end of the period. In fact, students will often volunteer to work on computer projects during lunch, recess, and after school (Finkelman & McMunn, 1995; Lehrer, Erickson, & Connell, 1994; Neal, 1995; Riddle, 1995; Tierney, Kieffer, Whalin, Desai, Moss, Harris, & Hopper, 1997, online document).

The students in this study were visibly excited on the days that I arrived to work with them and often asked if they could stay after school to work on the project. Even when there were interruptions or distractions, the web crawlers were vigilant in maintaining their task orientation. This level of engagement is difficult to achieve in any other subject area. It will be interesting to see if it is maintained when the novelty of using computers in school "wears off."

Another significant benefit of this type of project is the amount of collaboration that it requires. Although these students did not always find it easy to collaborate (see the Challenges section), all of them mentioned it as an integral component of their experience on the team. Brian found that webpage design involved teamwork and reflected that this project provided good experience in working with others:

> Well, with us, we have, like, a team on each webpage, and we have to, like, probably agree on something. And when you have to do another project that you work with other people, you'll have experience and you'll know what to do.

Maria expressed similar thinking on this subject:

> You have to work in groups at work and at school and, like, in different places -- like, all...all the times in life. And, like, when you're making a webpage you have to work in a group to compromise with other people, and in everyday life you have to compromise with other people that you don't even know. So, I think it's a great experience.

Jason, too, spoke of collaboration and how it requires the acceptance of other people's ideas:

> You can't just say, "No, I don't want that" or "Yes, I want this." And, like, you haveta, haveta be open-minded and think about stuff.... Just because you don't get along with someone real well doesn't mean that they can't have good ideas. If you can't get along with them you still haveta.... I mean, they can have a nice idea -- just 'cause you don't get along with them you shouldn't just throw it out the window.

Many researchers have lauded the hypermedia design process as a means for promoting student collaboration. For example, Finkelman and McMunn (1995) suggest that hypermedia authoring can enable "more social interchange because students have to ask questions, give answers, and provide explanations and feedback to each other" (p. 12). As Skye reflected,

> 'Cause you get kind of mixed up sometimes and you have to ask other people, and then sometimes there's two people working on a page and you...you have do a lot with other people 'cause it's not really on-your-own stuff, and you have to work with other people to learn how to do it and to be able to do it, and you don't do it just all by yourself.

Unlike traditional school writing assignments in which students usually work silently and alone, hypermedia design seems to lend itself to group authorship. It has been suggested that the public nature of the computer screen invites more collaboration than does the printed page (Downes & Fatorous, 1995). The pedagogical benefits of group authorship are described by Lehrer, Erickson, and Connell (1994, p. 229):

> The educational virtue is that collaborative authorship provides students with opportunities to view knowledge as distributed, to see one another as resources and sources of knowledge, to develop critical skills in arguing for one's own viewpoint, and to collectively develop ideas that might be out of the reach of individuals.

It was interesting to observe that while the students had originally decided to work in pairs on different thematic sections of the website, what actually happened was that each student naturally assumed a functional role such as the "technical expert" or the "community link" (see the Methods section's description of the students). This meant that the students had to use one another as resources for all of the webpages and depend on one anothers' talents and abilities for reaching a common goal. This collaborative model is not unlike that found in the modern workplace.

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Challenges

The majority of research literature on hypermedia design cites two serious challenges to the successful implementation of such projects in K-12 schools: time constraints and equipment limitations. Both of these factors were daunting obstacles in this study, as were lack of technical skills and disharmony among students.

Time factors posed significant problems during this project. First, I was not on campus every day, and the days that I was not there tended to be unproductive for the students because they hadn't developed the trouble-shooting strategies necessary to wrestle with the "archaic and unusable" (Marc's words) equipment in the computer lab.

Second, the students initially spent a lot of time pursuing links on the Internet that proved unfruitful to their searches (though there were no problems with their visiting inappropriate sites). This improved toward the end of the project after the students had had opportunities to hone their search skills, but we are all aware of how time-consuming locating relevant data on the Internet can be.

Third, as is always the case in schools, we experienced frequent interruptions from assemblies, the intercom, other teachers, other students who were curious about what the web crawlers were working on, and even from the media arts teacher himself.

Finally, collaboration itself can be an extremely time-consuming process. At the initial stages of the project, the students' themselves often chose to collaborate "in order to save time" (April's words), but they discovered that collaboration generally results in quite the opposite. In her final interview, April reflected on the laborious process of collaboration:

> Well, there's a lot of cooperation involved. You have to cooperate with your team members . If one says "yes" and one says "no" -- like me and Skye just, like, five minutes ago.... -- and then the other person says, "Well let's see who can choose, huh?" And they're looking at you going, "Raarrrrr" [noise as from a cat fight]. So, I think that you have to work together and, um, you have to use your cooperation skills and you also have to use flexibility. If one person wants to do one thing and the other person wants to do another, you have to change your ideas and say, "Well, OK," and compromise.... But sometimes it takes extra time.

The time-consuming, laborious process of collaboration, negotiation, and compromise is illustrated in this exchange between April and Jason as they started their initial work on the sports and clubs webpage:

> April: What color should we make [the text]?
> (Jason does not respond.)
> April: Pink, red, pink, red?
> Jason: Red.
> April: Let's make it pink.
> Jason (typing in "You can't beat the mustangs!"): Now, how do we center it?
> April: Click here.
> Jason: How do we make it bigger?
> April: You gotta highlight it first.
> Jason: That's all I can think of (sits back as if done). Yeah, we want it up here.
> April: Right there? (moves his headline down)
> Jason: Hey, man, you get back up there!
> April: No!
> Jason: Yeah! (moves it back up) All right. Now someone might get a little offended by that [headline].
> (April grabs the mouse and deletes what Jason wrote.)
> Jason: No! Ahhh! She's deleting my work!
> April: You're terminated, man!
> (Jason regains control of the mouse and retypes his headline.)
> April: No, no! It looks corny. No! It's corny! It's corny!
> Jason: Well, I think it looks real nice. Now everybody'll want to read sports and clubs.
> April: No! It's corny.
> Jason: All right. (Jason gets a new inspiration, and types "Get off the couch....")
> April: Oh, yeah! That's right!
> Jason: You were in sports! You guys made [that slogan] up! "Get off the couch...," or something?
> April (deletes Jason's text again and starts typing): Get off the couch and act like a mustang! (doing a little dance to illustrate) Get off the couch and act like a mustang! (in a sing-song voice).
> Jason: It's corny, it's cheesy (teasing by imitating April's earlier remarks).

Equipment limitations, the second challenge to successful use of computer technology in the curriculum, have already been alluded to several times. Not only is it difficult for schools to keep current with hardware and software due to funding shortages, but in small districts there is generally a paucity of experts available to solve technical problems. This was certainly the case at FWJHS. As April lamented, "Three-quarters of our lab is, is just crashed. All the computers are messed up." The magnitude of challenges in this area is revealed in the following sequence of entries from my researcher reflection log:

> *October 2:* FRUSTRATING!!!!!! Started extremely late because the main computer kept crashing and we had difficulty getting online until the end of the period.

> *October 8:* Another frustrating day struggling with hardware and software. It took 90 minutes (the whole period) to fix the problem! I'm going to have to come back again tomorrow or perhaps over the weekend.
>
> *October 15:* Main computer was down again today. What are we going to do?
>
> *October 16:* I think our web project is about 6 months too early.... We're trying to accomplish something that the school building just isn't ready for.
>
> *October 22:* The main computer might be taken away for a while. That is really going to put a crimp on our project.
>
> *October 29:* One of the client computers wouldn't work again today. Unfortunately, it is the one that has extra memory and the scanner software. That is our best one for uploading webpages.
>
> *November 6:* I was so thrilled that I got the modem to work today! Also, we finally got a dial-up account for the junior high so we can stop using mine.
>
> *November 12:* The modem wouldn't connect before class, but then it worked after class. It's so unreliable! I'm concerned about the future of the project.

The students themselves were painfully aware of the multitudinous technical problems in the computer lab but were amazingly resilient and remained undaunted. As Jason noted,

> Computers will shut down and not work. They wouldn't, like, do what we wanted 'em to do, so it kinda slowed things down. If that...if that wouldn't of happened I think we'd probably have this a lot further along than we do, but, for what the computers have done, I think we really did well with it.... Try not to let problems frustrate you too much. Like I said, if the computers don't wanna work, you can always find a way to do what you need to do and not get frustrated and mad and everything.

Even if this type of project is carried out in a state-of-the-art computer lab, there are still challenges related to the technical skills students require. At a minimum, students need to know how to connect to, browse, and search the Internet and how to scan and manipulate images, code text and pages for posting, save and copy files, and upload files to a server.

When asked what was the most difficult aspect of the project, all of the children responded in the same fashion: "getting on the Internet," "finding stuff on the Internet," "saving and copying files." In her journal, April wrote, "I am so excited about finally getting this up and running and getting a real page going. I lost [electronically] all the stuff we made and that discouraged me but we remade it and I'll survive."

The technical training took much longer than I had anticipated, forcing me at times to contradict my own philosophy of inquiry-based education. There were occasions when, in the interest of expedience, it was more efficient to provide direct instruction than to wait for the students to discover a need and address it on their own. As I wrote in my reflection log toward the end of the project,

> Graphics have turned out to be a much bigger factor than I imagined.... I hope we'll still have time for writing! This was supposed to be a literacy project, but it's turned out to be more of a "learn the software" activity. This must be what computer literacy is all about.... I've learned that the technical training takes much longer than I thought. The kids haven't really begun the actual design process after seven weeks of exploration!

The final challenge to collaborative hypermedia design that I will highlight is the downside to collaborative models of instruction. Besides being time-consuming, this approach can also lead to competition, hurt feelings, and outright hostility. For example, when I asked April what her least-favorite part of the project was, she replied matter of factly, "Working with my teammates. It really stinks sometimes." There was a significant turning point in the fourth week of the project when the students, who were in two different classes, asked if they could meet as a group of six one day. I then arranged for three of them to skip a class so they could meet with the others to share ideas and collaborate. Although there hadn't been much conflict within each triad, there was a great deal of competition between the two groups (particularly between the girls, who were split evenly between the two groups) -- so much so that most of them wrote about it in their reflection journals and were still harboring unspoken resentments toward each other several months later:

> *Maria:* Today both groups came together. It was frustrating because the other class wouldn't listen to our group. They were so stubborn. But it's cool. I don't have to talk to them anymore. I think it's going to be hard to use our ideas together. We will just have to cope.
>
> *Danielle:* I thought today's Pow-Wow of both of the classes was a giant step forward! I feel we are finally really getting started on designing. It was really neat listening to everyone else's designs and ideas. I really hope it turns out. We'll see. P.S. I felt there was alot [sic] of competition between classes.

This disharmony and competition was also mentioned by most of the students in their final interviews:

> *Maria:* Well, that one day when we were with the other class, I didn't really like that, just because I don't work well with people that I don't know, and I just felt more comfortable with Danielle and Brian, just because I know them and I'm with them, like, every other day in a class. I don't know, I just didn't know the other...the three other people very well. It was just uncomfortable for me because I didn't feel like I could say anything because then they'd get the wrong opinion of me.
>
> *Danielle:* I just think it was, it was a lot of work, and I really sincerely think that we should have had all the people in one class. I think....if they were to.... You know, next year when they're updating [the website]? I would have them in one group. I don't know, I felt kinda tense when I was with the other group. I didn't.... I guess we were just competing majorly and I was...I felt like they were rejecting our ideas, making us feel inferior, but nobody can make you feel inferior without your consent. But it's...it's still.... They were trying real hard.

Interestingly, neither of the boys seemed to perceive competition between the groups. Brian didn't even mention the event in his journal, although he did have a difficult time persuading anyone to listen to him during the whole group meeting (in fact, he resorted to waving his hands in the air and shouting, "I have an idea! Listen to my idea!" to which no one responded). Jason's journal entry from the day of the meeting is actually quite positive, although he acknowledges the tension that existed:

> It was cool to finally meet the other group. They have a lot more ideas. I'm glad we have groups because I think we'll be moving much quicker now. I felt a little tension between everyone but it turned out all right.

In sum, although there are exciting benefits to having students design school websites, there are also some significant challenges. Educators need to take these challenges into consideration when making decisions regarding the use of hypermedia technology in the classroom.

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Benefits for Language Arts

As a language arts educator, I have a particular interest in how multimedia technology and telecommunications can

be harnessed into the language arts curriculum in ways that may offer specific benefits beyond those already discussed. Throughout the study I paid close attention to the traditional language processes of reading, writing, speaking, and listening that the students employed as a natural part of engaging in hypermedia design. I was also interested to see if the students used any other kinds of literacies during the process of constructing the school website.

Besides employing the four "traditional" language processes, I discovered that the hypermedia design process prompted students to use problem-solving and critical thinking skills. Further, in using hypermedia to express themselves to an authentic worldwide audience, the students exercised two additional types of language processes specific to multimedia-based literacy. These I have termed *interpreting* and *composing*.

Print-based literacy: Reading and writing. Throughout this design project I observed the students engaging in various traditional print-based literacy activities. For example, the students read lesson handouts, took notes, wrote in their reflection logs, outlined interview protocols, wrote announcements for the school newspaper, read text online, and composed short texts for their webpages. Although they did not engage in reading and writing *extended* text, they used skills of previewing, skimming, checking, and rereading while browsing and composing online. This sort of reading in hypertext environments will be a necessary literacy for the 21st century. (For thorough discussion of hypertext reading skills, see Anderson-Inman, Horney, Chen, & Lewin, 1994; Horney & Anderson-Inman, 1994; or Reinking, 1994.)

One of the most compelling findings of this study is that all the student participants had a strong sense of a diverse worldwide audience while constructing the website:

> *Maria:* Because to design a webpage you have to, like.... When you're making a page you have to write, um, like, links. You have to make them understandable for little kids, old people, and, like, middle-aged people to understand. And, like, you have to be very versatile with what you write.
>
> *Danielle:* You need to know what's interesting to other people to write about. And, I mean, the webpage.... You can't just have information, just like, it's supposed to be information, but you've gotta make it fun to read so you gotta learn language skills to use the right words to attract people to your webpage.

It was a momentous event when the students received their first e-mail from a "real" reader. An alumnus of FWJHS, now in his late forties, discovered the students' website while trying to find a website for the district high school. His message read as follows:

> You people did a great job on your web page! I graduated from Flowing Wells Jr. High in 1966, that of course is when it sat next to the High School. I went on to attend the High School until 1968, then moved to Alaska and finished there. I started in Kindergarten at Iola France Elementary in 1957. The Jr. High was basically sandwiched between the Elementary School and the High School in what at the time was referred to as "the portables."
>
> The reason I'm writing is because several months back I tried and found the High School site, there wasn't much there and as of today I can't find it again. You students have a great oppportunity as you move into High School to improve on that web page and create an enviroment where you will be able to sign on in the future and stay in touch with your friends. Alumni lists and class reunions are perfect for the Internet. If you need to see what I mean, check out "alumni.net" or "classmates.com".
>
> You may not think too much about it today, but 15 or 30 years out of High School there will be someone out there you'll wish you could say Hi to, one more time. Don't take my word for it, ask any adult. And when you do, look at their face and you'll see a little mist in the eyes, a far off look, and maybe hear a sigh.

> So get to work and graduate. Get that site up and running. We (the alumni) are out here and we will be watching and waiting. Good luck and good fortune.

The pedagogical benefits of students' having a sense of audience when they write are well established (Cohen & Riel, 1989; Lehrer, Erickson, & Connell, 1994; Neal, 1995). The existence of an authentic audience inspires students to produce higher quality work than they might when writing for an audience of one (usually the classroom teacher). Skye and Brian explained this phenomenon:

> *Skye:* Well, if I were to design my webpage, then it's kinda like.... If everybody's gonna be reading it, then you're gonna try to make it as nice as you can, and like, not sound like some little girl is, like, writing it or nothing, and then.... 'Cause everybody's gonna be seeing it.
>
> *Brian:* Because when you make a webpage, you, like, have to type words and you have to read over it and recheck it and make sure you wrote it right and make sure it sounds right, 'cause you don't want somebody saying, "What does that mean?"

The opportunity for students to publish their writing on the Internet has enormous potential from the perspective of a language arts teacher. The students were most definitely aware of this potential -- as Danielle noted, "Instead of getting a story published, you could get it on the Internet and let the world read it, which would be pretty awesome. I've always wanted to do that with one of my stories." The web crawlers took turns making weekly school-wide announcements about their student works contest, with the goal of publishing student writing and artwork on their Student Honors & Works webpage.

Danielle describes the thrill of seeing her own work on the computer screen (see Figure 9) in this way:

> It's like, your own product. And it's pretty cool to see your own, like, my drawing.... When my drawing came up on the computer screen it was like, "Oh, my gosh! I drew that!" you know? 'Cause it's...you don't usually see it on a screen. It's just.... I think that was really special.

Figure 9
Danielle's Original Mustang Drawing

[image omitted]

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Oral literacy: Speaking and listening. In addition to print-based literacies, the students were aware of the need to use oral literacy during this project. Not only did they have to listen to me as the instructor, but they had to communicate with one another and with people they interviewed (see Figure 10) in order to achieve the common goal of constructing the website.

Figure 10
Interviewing the School Principal and Vice-Principal

[image omitted]

Two of the students, Jason and Skye, were brave enough to present the website to the entire staff before school one morning toward the end of the project (Figure 11). Preparing and delivering a coherent presentation to 90 adults would challenge anyone's oral language skills, let alone a 12- or 13-year-old presenting to an audience of his or her own teachers.

Figure 11

Staff Meeting Presentation

[image omitted]

Regarding the use of speaking ability while constructing a website, the students shared some sage advice, such as Maria's comment that "you have to ask questions when you don't understand things so that you don't have them in the future when nobody's there to help you." Maria elaborates further:

> You have to be able to communicate with other people that you're making the webpage with. Not necessarily, like, on an everyday basis -- but you have to be able to say what you mean, or what you want to accomplish, what you need to have to make a good webpage. You can't just be, like, a hermit and, like, just sit there and not do anything.

Jason shares a similar observation:

> Like, to explain stuff that you want.... Like, if you wanted something on the webpage, you have to be able to explain it real well and when you...when you say things you have to say it real specifically.

In reference to using listening skills as part of the web design process, Danielle suggested, "Well, first you gotta learn how to do it. I guess that's half the battle: listening to the person who's trying to tell you how to do something." Skye offered a similar piece of wisdom, noting that designing webpages "is kinda hard, so you have to listen to people to be able to do it.... You need to know what you're doing, otherwise it's gonna be all messed up. And you're not gonna be able to get started."

Oral literacy tends to be overlooked in favor of print-based activities in many language arts classrooms, particularly in the upper grades. Integrating hypermedia design projects into the curriculum is one way to bring oral language back under the language arts umbrella. This contention challenges the widespread fear that multimedia activites are going to replace the traditional language arts; on the contrary, the language arts of creating, organizing, and delivering effective spoken communication -- important since before the advent of print -- may take on an even greater role in today's multimedia world. Lemke (1993; online document) goes so far as to predict that mass schooling may actually be reverting to the oral tradition from which it began. While Lemke's may be too strong an assertion, this study does suggest that hypermedia design projects have the potential to enhance students' oral literacy skills.

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Hypermedia literacy. Hypermedia design is complex and challenging. In the course of constructing the school website, the students had to apply problem-solving and critical thinking skills throughout the process. They also employed two multimedia-based language processes that I have termed *interpreting* and *composing*.

When asked what they felt they'd learned as a result of this project, most of the students identified "working with other people" and "computer skills" as the top items. The students' responses to the question of what advice they would give others who might try to make a school website offer a window into their perceptions of the process involved in composing with hypermedia. Brian advised other students to "take your time...be patient...get organized...and make a schedule." Maria recommended compromise, organization, and patience, because "sometimes the computer is retarded and it doesn't work." Danielle counseled, "I would tell them that planning would be the best part, planning it out step by step, like we did. 'Cause if we had just got in there and just tried starting to make it, I don't think we would have...gone anywhere. I think the planning, the storyboarding, and, first, looking at other [schools'] pages was a really good idea."

This lengthy process of planning, critical thinking, and problem solving is further explained by Jason:

> Oh, I'd tell 'em to be open-minded, think about everything, go through every step, go through step one and go all the way through. Don't just try to rush through it, 'cause that won't help it. And also, go for quality over quantity. You don't want too much stuff and have it not be any good. [You should] have a little bit of stuff and have it be really good.

Based on my observations and on these student remarks, it is clear that the process of hypermedia design demands collaboration, organization, planning, critical thinking, and problem solving. These are exactly the kinds of skills and strategies that educators seek to promote.

The hypermedia environment is also a semiotic medium through which students experience not only new forms of representation but can also create their own new forms of expression. Several of the students recalled the excitement of seeing things on the Internet that they'd never seen before -- as April said, "Wow! I've never seen anything like that before!"

Themes associated with this view of the Internet as a unique semiotic medium are beginning to emerge in the research on hypermedia design in the classroom. For example, students interviewed at the end of one hypermedia design project reported that its most satisfying aspect had been "the freedom to design their own presentations and the opportunity to incorporate a variety of media into their projects" (Finkelman & McMunn, 1995, p. 2). Similarly, the students that Tierney et al. (1997; online document) interviewed stated that multimedia "afforded opportunities to engage in ways of connecting ideas that otherwise would have been less possible with traditional texts." Through transmediation, students have "the opportunity to see how the same piece of information could be transformed in multiple ways through its participation in different systems of knowledge" (Lehrer, Erickson, & Connell, 1994, p. 231). The dynamic, interactive, and multisensory qualities of multimedia and the web enable students to "express themselves and their worlds differently than they do with traditional learning materials" (Riddle, 1995, p. 7).

In my study, April was especially stimulated by the experience of expressing herself in a medium that combines many symbol systems:

> It helps me explain basically who I am. If I see some really neat background, I go, "Yeah, that's what I mean".... It helps a person express themselves. So, I think that it could improve your writing because you could...you could tell more about your experiences or it could help you describe things better. So, you really don't have that experience anywhere else.

Within this new medium, the students engaged in two new forms of language processes that reach beyond the four traditionally recognized language arts of reading, writing, speaking, and listening. At the beginning of the project, they spent several sessions analyzing other schools' websites with the purpose of critically evaluating their communicative strengths and weaknesses in terms of content, appearance, and organization. In order to accomplish this task, the students needed to be able to *interpret* the multilayered, multimedia messages that the other sites were designed to convey. This critical thinking process involved far more than "just" reading.

Similarly, when the students were constructing their own webpages for the site -- determining its overall organization and appearance (including background patterns and colors, text colors, fonts, images, and animation) and negotiating the placement, emphasis, and relative sizes of the different forms of representation on each page -- they were engaging in a complex process of *composition* that involved a great deal more than "just" writing.

I therefore propose that language arts educators begin to view the standard language arts model more broadly, to include the multimedia-based language processes of interpreting and composing (see Table 3). Sign language also uses the word *interpreting* and it, like multimedia, is a process that represents a semiotic system extending beyond print- or oral-based language. Similarly, music, in which *composing* is crucial, represents an alternate sign system that constitutes a form of expression, as do multimedia, drama, dance, and the visual arts.

Table 3
Language Processes

	Print	Oral	Multimedia
Receptive	reading	listening	interpreting
Expressive	writing	speaking	composing

Adapted from Goodman (1996).

If multimedia processes are added to the traditional language arts model, then educators will need to incorporate multimedia-based content into their language arts curricula. Because multimedia applications and telecommunications are becoming increasingly widespread and will only grow in importance, it is time to begin teaching our students how to interpret and compose hypermedia texts. This is not to suggest that these new technologies are replacements for the old. As Rose and Meyer (1994, pp. 293-294) point out, *all* the language processes will continue to be required for effective communication:

> As technology development expands with blinding rapidity, one thing about language arts education is clear: As our children grow up, they will use not one technology but many. It will not be sufficient to teach children merely how to be effective as writers, or speakers, or even multimedia composers. It will be necessary to teach them how to be effective in each and, most importantly, how to choose the most effective medium for the job.... Language arts must be defined as an expanding set of communicative skills, and language arts instruction must begin to encompass competencies in the use of varied media. The role of language arts instruction is to teach children to communicate effectively. Ever since Plato, that role has involved teaching children to use the most powerful tools available. For centuries, the most powerful tool has been print. For the centuries ahead, the toolbox will be much bigger. And better.

I will conclude this discussion of my findings regarding the purposes, processes, benefits, and challenges of student-designed school websites with insightful words from Jason, who produced this gem in response to the question, "What are some other situations that making a webpage could be useful for beside making a school website?"

> *Jason:* Um, like, to let people know about stuff.... Like, if you knew a lot about something, some certain subject -- 'cause, I mean, there's so many people in the world, there's no doubt that any subject you make it in, somebody's gonna wanna learn about it. So, no matter who you are, that's why everybody makes webpages, 'cause they know that somebody out there that wants to know about it. Somebody out there wants to know about their toilet paper.
>
> *Author (laughing):* I'm very curious about the toilet paper!

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Conclusion

In this article, I shared the insights of student participants in order to address several questions regarding the use of hypermedia design in K-12 schools. The results of this study add to the professional knowledge base in several significant ways. The students identified several meaningful purposes for constructing a school website, aside from the obvious one of educating and informing people about the school. These can be categorized as (1) giving students a global voice; (2) showing the world that they are up to date; (3) communicating a sense of school pride; and (4) attracting students to the school. Giving students, rather than teachers, ownership of the school website can have numerous benefits for the junior high school culture.

I also sought to discover what kinds of general pedagogical benefits and challenges were involved in creating a school website. Benefits included student empowerment, motivation, and collaboration; challenges included time constraints, equipment limitations, lack of technical skills, and disharmony among students. Educators would be well advised to take these challenges into consideration when making decisions regarding the use of hypermedia technology in the classroom.

Finally, I investigated the potential benefits of a student-designed school website for the language arts curriculum. I found that, in the natural course of constructing such a website, students utilized print-based literacies, engaged in oral literacy, applied problem-solving and critical thinking skills, and employed the multimedia-based language processes I termed *interpreting* and *composing*.

Although there are significant challenges to the successful integration of multimedia technology in K-12 schools, collaborative hypermedia design and publication on the Internet can provide students with an authentic audience for their work and constitute a new form of semiotic expression. Based on the results from this study, I conclude that the four generally recognized language arts processes need to be expanded to include multimedia-based literacies. The ramification of adding multimedia to the traditional language arts model is that educators must begin to incorporate multimedia-based content into their language arts curricula.

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Limitations

This qualitative research project has several limitations that may prevent some of its findings from being generalized to other students, schools, or situations:

- The project was completed over a very short time period for this genre of research and is therefore somewhat limited in its scope.
- The six student participants were volunteers for the study from within an elective class, which may

render them less than representative of the total school population.
- Although I was a teacher-researcher in as much as I served as the student participants' teacher for this project, I was not the regular classroom teacher and was therefore not responsible for the rest of the media arts students. This allowed me a great deal of freedom to focus on the specific needs of the web design team.
- The project was housed in a media arts rather than a language arts setting, thus possibly limiting its applicability to the language arts curriculum.
- The results from this study on school website construction might not be generalizable to all forms of hypermedia design, although many parallels were drawn in this article.
- Some of the findings may be the result of a novelty effect that could fade over time.
- Some of the excitement that the students experienced is related to the singular fact that they were the first in the school to create the website; therefore, some of these results might not be replicable with future groups of students.
- Finally, there may have been confounding effects from the instructional model (collaborative, constructivist, inquiry based) that cannot be rightfully be attributed to the instructional medium (hypermedia design). Leu (in press) notes that this is a common problem with research in hypermedia design.

I encourage readers to integrate the information that seems relevant to their own current situations and to put aside the rest as a compelling story of student voice, empowerment, and pride unique to the nascent culture of the FWJHS web crawlers.

Due to these limitations and as a result of further questions that may be raised as a result of this study, I suggest that future research be conducted by a collaborative team of teacher-researchers over a longer period and with a larger sample of students. It would also be informative to design a study in which all of the students are given opportunities to compose authentic, collaborative hypermedia projects that reflect the students' own areas of inquiry.

Brian: Today was awesome!!! We finally got started.
It also seemed like we got somewhere. The main page
and teachers page are looking awesome!! This is fun!!
Bye!!

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Epilogue

This article is going "to press" more than a year after the study was conducted; therefore, I thought the reader might appreciate an update on the student participants and the school website as well as some additional thoughts from the researcher.

In the spring semester of 1998, the gold group (Danielle, Maria, and Brian) dropped out of the web design project in order to learn about video production and to work on the school newspaper. The blue group (April, Jason, and Skye) trained two new web crawlers on their own, while I continued visiting the school once a week to support the media arts teacher and the web team. By the end of the 1997-98 school year, the school website boasted 28 webpages and no obvious navigational flaws. Now, during the 1998-99 school year, there

is a new group of web designers working on the site, with Brian serving as a consultant. (In fact, Brian has now created his own personal webpage.) This year's team has chosen to create the current school website from scratch rather than build on last year's template; therefore, both sites will be linked off of last year's school page located at http://earthvision.asu.edu/~maya/fwjhs.

I am now engaged in a full-scale research project at the school, but this time I am working with a language arts teacher rather than exclusively with the media arts teacher. We are putting the school newspaper online and are initiating a student-run electronic magazine (e-zine) project. One seventh grade language arts class is responsible for determining the content, structure, and layout of the e-zine, while the rest of the language arts classes are submitting original written work.

Although it is too soon for detailed data analysis, I am discovering additional challenges to integrating multimedia technology and hypermedia design projects in the language arts curriculum. First, there is the serious issue of access to computers. Many language arts teachers do not have computers in their classrooms; therefore, students must leave the room to work on hypermedia design projects. This poses obvious problems with monitoring student usage, troubleshooting, and ensuring equal access. If there happen to be a few computers in the room, there are still problems with access and noise control.

The second challenge involves time. Students generally need 60 to 90 minutes of uninterrupted time to work on computer projects, which obviously limits the time available to address other curricular needs and projects. In an inquiry-based curriculum this may not be critical; however, in a more traditional curriculum it would be a significant problem. If teachers are required to "cover" district-mandated content such as grammar units or whole-class novel studies, then there will be a conflict of interest in terms of the time needed to devote to hypermedia design projects.

Third, there is a challenge for language arts teachers in terms of grading student work. Because computer-related instructional objectives and outcomes are unclear at this time, it is difficult for teachers to assess student progress in computer-mediated curricula. Further, there is the additional challenge of trying to assign grades to collaborative work.

Fourth, there will always be a few students who are not interested in computer-mediated learning. Conversely, there will always be some who like it so much that they neglect other modes of communication. No medium is perfect for all student needs; therefore, language arts teachers are advised to provide many different kinds of opportunities for students to construct meaning and communicate their understandings with others.

Finally and most important, many hypermedia design projects do not demand *extensive* reading and writing of printed text, as was evidenced in the student-designed school website project reported here. Since the major objective of language arts instruction is still based on traditional reading and writing, some language arts teachers may hesitate to devote a great deal of class time to hypermedia-based literacy. The antidote to this challenge may be to offer computer-based projects that *require* reading and writing printed text, such as online newspapers, electronic magazines, student-initiated research projects, keypal projects, or online curriculum projects with other schools around the world. In this way students can explore print-, oral-, and hypermedia-based literacies as a natural outcome of learning and inquiry.

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Transcript of the Discussion Forum

Editors' Note: When this article was posted in *Reading Online* in April 1999, readers were invited to comment on it through a bulletin board feature that was discontinued when the journal was redesigned in July 2000. Following are the comments posted to that bulletin board.

Readers who would like the opportunity to comment on this or other articles in the journal are invited to contact the author directly (e-mail address is available on the opening page or to post messages through ROL Communities.

Post 1

Author: Cynthia_Collins
Date: 07-07-1999 17:40

I am so glad to see teachers who are concerned about students and how they will 'fit in' in the technological future of the world. This article proves that teachers who plan authentic research projects that set out to answer important questions can provide insighful information to the educational community. What does the Internet and the mass number of web pages created by individuals, corporations, and educational institutions mean for the future of our students? How does the computer impact our global world? The only way to find out is to allow kids to explore. I know that I have only realized the potential and power of the computer during the last six months while playing on the Internet. Now, I view the computer a large interactive television/telephone combination that allows anyone to disseminate information and thoughts. Wow! I may be a little knaive, but every student in the world needs to have some experience with the computer and the Internet. I used to think it was the wave of the future, but recently I have realized that the future is here!

Reply 1a

Author: Maya_Eagleton
Date: 07-07-1999 17:40

I am happy to see that some readers are having a "Wow" reaction to this article! The future is indeed now. In what ways are you having your students to explore technology in your classroom? It isn't easy to accomplish, so I think it helps to share our discoveries whenever possible.Thank you for your response!

Maya

Reply 1b

Author: Hannah_Boone
Date: 12-06-1999 22:49

In her article, Eagleton was wise to give readers a detailed description of each student that played a part in constructing the school's webpage. I found the short characterizations of the middle school students helpful in understanding how previous useage of computer technology affects student's levels of comfort and creativity with technology. I believe the point Eagleton makes about students being behind if they are lacking in computer skills is well taken. As a future teacher with an ever-growing knowledge base about computer technology I hope to assist students that need to play catch up when it comes to understanding computer technology.

The method that Eagleton taught her students computer skills seemed to be effective as well. By teaching students about using the computer in a context of making a web page for their school the students learned the desired skills, created a valuable product, and took pride in their completed task. I was suprised that only several students continued on with the web page program but it seems as if, during the course of Eagleton's educational study, the students learned enough about useful internet and word processing procedures to retain the valuable information for later use.

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